

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MAKAREM A. HUSSEIN

Appeal No. 2005-2343
Application No. 09/672,375

ON BRIEF

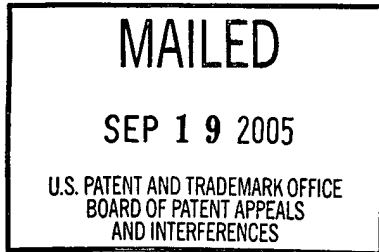
Before BARRETT, GROSS, and BLANKENSHIP, Administrative Patent Judges.

BLANKENSHIP, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 12-17, which are all the claims remaining in the application.

We affirm.



BACKGROUND

The invention is directed to an integrated circuit having barrier material (used to inhibit the diffusion of interconnection material) removed such that there is direct contact between interconnection lines. Representative claim 12 is reproduced below.

12. An integrated circuit comprising:

a substrate having a circuit device;

a dielectric material overlying the circuit device with a via formed in the dielectric material to the circuit device, the via exposing a sidewall in the dielectric material and a surface of the circuit device;

a barrier material substantially lining the sidewall of the via;

a seed layer on the barrier material and substantially lining the sidewall of the via; and

a conductive material directly contacting the surface of the circuit device.

The examiner relies on the following reference:

Obeng et al. (Obeng)

US 6,323,131 B1

Nov. 27, 2001
(filed Jun. 13, 1998)

Claims 12-17 stand rejected under 35 U.S.C. § 102 as being anticipated by Obeng.

We refer to the Final Rejection (mailed Aug. 23, 2002) and the Examiner's Answer (mailed Apr. 10, 2003) for a statement of the examiner's position and to the Brief (filed Jan. 30, 2003) and the Reply Brief (filed Oct. 1, 2004) for appellant's position with respect to the claims which stand rejected.

OPINION

Appellant submits groupings for consideration of the claims (Brief at 3).

However, based on the arguments presented in the Brief and the rules effective at the time of filing, we select claim 12 as representative of claims 12-14 and claim 15 as representative of claims 15 and 17. We will also consider appellant's arguments with regard to the separate requirements of claim 16. See 37 CFR § 1.192(c)(7) (2002). See also In re McDaniel, 293 F.3d 1379, 1383, 63 USPQ2d 1462, 1465 (Fed. Cir. 2002) ("If the brief fails to meet either requirement [of 37 CFR § 1.192(c)(7)], the Board is free to select a single claim from each group of claims subject to a common ground of rejection as representative of all claims in that group and to decide the appeal of that rejection based solely on the selected representative claim.").

The controversy with respect to claim 12 is whether or not Obeng discloses a conductive material "directly contacting" the surface of the circuit device. Although the left hand side of Obeng's Figure 1(d) shows thick copper film 20 in direct contact with thick copper film 20 (with the lowermost copper film 20 a "circuit device" within the meaning of claim 12), appellant submits that Figures 1(c) and 1(d) of the reference represent error in the patent figures. Appellant's position is summarized at page 5 of the Brief:

[S]ince Obeng fails to mention removing any portion of diffusion barrier / adhesion promoter film 18, copper seed layer, or spontaneous self-assembling film 24, a second level of interconnects formed over the

structure shown in Figure 1(c) would include at least those three layers between the second level of interconnects and the first layer.

The examiner's response, in part (Answer at 10), relies on a particular teaching of Obeng regarding the organic films used in forming the barrier layers.

We have found that spontaneously adsorbed self-assembled mono-layer or multi-layer organic films can be generated on metallic copper surfaces so as to provide a passivating film thereon which protects the surface from atmospheric corrosion. In addition, such films can provide a temporary barrier layer between the substrate and the copper interconnects. When used as a barrier layer, receptor sites in the membrane capture and bind divalent ions such as copper, zinc and cadmium ions and prevent their migration into the substrate. Generally, these barrier membranes may be destroyed during subsequent plasma/wet etch processing.

Obeng col. 2, ll. 51-61 (emphasis added).

The self assembling organic films may serve as film 24 and as barrier/adhesion promoter film 18. Col. 4, ll. 9-35; Figs. 1(c) and 1(d). The films are to prevent the diffusion of copper into the underlying active substrate and to prevent air corrosion on the surface of the copper. Col. 1, ll. 19-25; col. 2, ll. 6-14.

Figure 1(b) of Obeng appears to contain an ambiguity, showing an unlabelled structure at the bottom of right hand side via 16 (Fig. 1(a)) that appears to be separate from diffusion barrier 18. The description of chemical mechanical polishing (CMP) as applied to copper layer 20, followed by passivation with film 24, does not appear to account for disappearance of the unlabeled structure in Figure 1(c). Col. 3, ll. 60-67; col. 4, ll. 25-32.

However, Figure 1(d), left hand side, does not show either of film 24 or barrier 18 between copper layer 20 in the upper level and copper layer 20 in the lower level of the depicted structure. According to the above-quoted column 2 teachings of Obeng, film 24 (and, if necessary, barrier 18) may be removed by plasma/wet etch processing, which, on this record, can explain removal of a portion of film 24 from the lower level analogue shown in Figure 1(c), such that copper layers 20, 20 can be in direct contact (Figure 1(d)).

The examiner posits (Answer at 6-7) that the films described by Obeng are electrical insulators, and thus would not be placed (or allowed to remain) between copper layers. Figure 1(d) of Obeng appears to be consistent with the examiner's position, as film 24, if a conductor, would electrically interconnect the two depicted -- and all the not shown -- conductors in the lower level of the structure. We do not find a satisfactory response to the position from appellant in either of the briefs.

We disagree with appellant's assertion (Reply Brief at 9) that Obeng specifically describes removal of copper layer 20, the seed layer, and barrier layer 18 "where desired." The portion of the reference quoted mentions only copper layer 20. We also disagree with the position (Reply Brief at 8) that Obeng's claims require a barrier layer between copper interconnects. Claim 8 of Obeng, for example, reads on layer 18 surrounding the lower surfaces of lower level, left hand side copper film 20 in Figure 1(d).

Appellant contests the examiner's finding that a passivation material is not needed between two copper layers -- because there is no air to cause corrosion, and no substrate between layers -- deeming the position "illogical." Appellant suggests there is a requirement that the copper be exposed to air during the interconnecting steps of manufacture. (Reply Brief at 14.) Appellant does not provide any evidence in support of the assertion. As with the entire response to the rejection, appellant has adduced no evidence in support of the positions set out by appellant's counsel. Arguments of counsel are not evidence. See, e.g., Meitzner v. Mindick, 549 F.2d 775, 782, 193 USPQ 17, 22 (CCPA 1977); In re Pearson, 494 F.2d 1399, 1405, 181 USPQ 641, 646 (CCPA 1974).¹

The examiner has provided a satisfactory explanation for the depicted absence of at least barrier layer 18 and film 24 between copper layers in Obeng. For the purposes of representative claim 12, we need not consider whether there may be an intervening seed layer. The claim defines the seed layer as on the barrier material and substantially lining "the sidewall" of the via. The claim does not preclude that the "conductive material" directly contacting the surface of the circuit device contain seed layer material that is not part of the material lining the sidewall of the via.

¹ We note, further, that the submission of evidence in support of readings that appear contrary to the disclosure of a reference is particularly indicated in the case where, as here, that disclosure is based on the discovery of novel uses of materials that are atypical in the art. See, e.g., Obeng col. 1, l. 54 - col. 2, l. 14.

What a reference teaches is a question of fact. In re Baird, 16 F.3d 380, 382, 29 USPQ2d 1550, 1552 (Fed. Cir. 1994); In re Beattie, 974 F.2d 1309, 1311, 24 USPQ2d 1040, 1041 (Fed. Cir. 1992). We agree with appellant to the extent that the instant reference is not a model of clarity. Upon consideration of the respective positions and the entirety of the reference, we conclude that the examiner's interpretation is the better founded on this record. We are thus not persuaded of error in the examiner's finding of anticipation and sustain the § 102 rejection of claims 12-14.

Appellant's arguments in support of claim 16 consist, in the Brief (at 10), of substantial reliance on the arguments in support of claim 12. Appellant does, however, repeat the "wherein" clause process limitation of "wherein the seed layer and barrier material are formed so as to expose the circuit device at an end of the via."

Process steps per se cannot serve to limit product claims. See In re Stephens, 345 F.2d 1020, 1023, 145 USPQ 656, 658 (CCPA 1965) ("We think it well settled that the presence of process limitations in product claims, which product does not otherwise patentably distinguish over the prior art, cannot impart patentability to that product."). The relevant inquiry is how the process recitations might define structure. See, e.g., In re Garner, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1969) (recitation of "interbonded one to another by interfusion between the surfaces of the perlite particles" construed as structural limitation in product claim); In re Dike, 394 F.2d 584, 589, 157 USPQ 581, 585 (CCPA 1968) (no error in USPTO board holding that term "blow-

molded” in claims drawn to integral plastic container and handle failed to distinguish over prior art, because term related to process of making the article, and was not definitive as to the structure of the article).

In response to the examiner’s position that the patentability of a product claim is based on the product itself, appellant submits that the process step requires that the circuit device at an end of the via be “exposed with respect to the seed layer and the barrier material.” (Reply Brief at 15.)

The only express treatment of the “copper seed layer” of Obeng is at column 4, lines 20 through 24, describing deposition of the seed layer which is then capped with thick copper film 20 “by known techniques.” Both the examiner and appellant suggest that the seed layer may be represented by, for example, a somewhat darkened line underlying thick copper film 20 in Figure 1(b) of the reference. However, we find no evidence that a seed layer is shown in any of the figures. If a seed layer were depicted, it would seem that a reference numeral would apply, consistent with all other structures shown (with the possible exception of one structure in Figure 1(b) that we have addressed).

The examiner submits various theories as to why there would be no seed layer between the copper layers. At least the lack of depiction in the drawings, and the lack of discussion in the written description, of Obeng with respect to an intervening seed layer are sufficient to support the examiner’s finding that the process limitation of

product claim 16 does not distinguish over the product disclosed by Obeng. In the absence of evidence to the contrary, we fail to see error and sustain the § 102 rejection of claim 16.

Instant claim 15, depending from claim 12, recites that the barrier layer comprises an etch characteristic “such that the barrier material can be selectively etched in the presence of the seed material.” The examiner notes that the claim does not require any etching, and that the barrier material as described by Obeng inherently has the recited etch characteristic. (Answer at 10.) Appellant submits that the barrier material and the seed material in Obeng “may” have the same or similar etch rates. (Brief at 9.) However, the question of inherency with respect to claim 15 relates to what necessarily “can be,” rather than what necessarily “must be.”

In any event, in response to appellant’s request for a reference in support of the position that other processes (not expressly described by Obeng) may be employed to etch the barrier material in the presence of the seed material (Brief at 10), the examiner cites three different references (Answer at 11). In this instance, consideration of multiple references is appropriate within a § 102 inquiry. When a reference is silent about an inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Continental Can Co. v. Monsanto Co., 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991).

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We take appellant's silence in the Reply Brief with regard to the extrinsic evidence as acquiescence to the examiner's position that the barrier material disclosed by Obeng "can be," consistent with claim 15, selectively etched in the presence of the seed material. We sustain the § 102 rejection of claims 15 and 17. Even assuming there may be a credible argument contrary to the finding of inherency, appellant cannot now remedy the silence by submission of untimely arguments. See 37 CFR § 41.37(c)(1)(vii) (effective September 13, 2004, 69 Fed. Reg. 49960 (August 12, 2004), 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)) ("Any arguments or authorities not included in the brief or a reply brief filed pursuant to § 41.41 will be refused consideration by the Board, unless good cause is shown.").

CONCLUSION

The rejection of claims 12-17 under 35 U.S.C. § 102 as being anticipated by Obeng is affirmed.


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No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a). See 37 CFR § 1.136(a)(1)(iv).

AFFIRMED


LEE E. BARRETT
Administrative Patent Judge

Anita Pellman Gross
ANITA PELLMAN GROSS
Administrative Patent Judge


HOWARD B. BLANKENSHIP
Administrative Patent Judge

BOARD OF PATENT
APPEALS
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